

What is claimed is:

1. A clamping apparatus, wherein

An annular central pillar (20) is projected from a reference block (1) toward a leading end,
an inner sleeve (21) is fitted onto the central pillar (20) axially movably within a
5 predetermined range, and the inner sleeve (21) is advanced toward the leading end by a
predetermined advancing stroke by an advancing means (25),

an outer sleeve (31) to be inserted into a socket hole (3) of a movable block (2) makes a
wedge engagement with the inner sleeve (21) from the leading end side, and the outer sleeve
(31) is adapted to be diametrically expandable and contractible,

10 an output member (36) is inserted into a cylindrical hole (20a) of the annular central pillar
(20) axially movably, and a leading end portion of the output member (36) is connected to the
outer sleeve (31),

a locking means (51) and a releasing means (52) are provided in the reference block (1),
the locking means (51) moves the outer sleeve (31) toward a base end for locking via the output
15 member (36), while the releasing means (52) moves the outer sleeve (31) toward the leading end
for releasing via the output member (36).

2. The clamping apparatus as set forth in claim 1, wherein

in place of the outer sleeve (31), which is diametrically expandable and contractible, an
annular plug (71) to be inserted into the socket hole (3) is arranged on an outer periphery of the
20 inner sleeve (21),

a plurality of pressing members (72) are supported on a peripheral wall (71a) of the
annular plug (71) radially movably and are arranged circumferentially at intervals,

each of the pressing members (72) makes a wedge engagement with the inner sleeve
(21) from the leading end side, and each of the pressing members (72) is movable radially inward
25 by a restoring means (74),

the leading end portion of the output member (36) is connected to the annular plug (71).

3. A clamping apparatus, wherein

an annular central pillar (20) is projected from a reference block (1) toward a leading end,
an inner engaging member (21) is arranged on an outer periphery of the central pillar
30 (20),

an outer engaging member (31, 72) to be inserted into a socket hole (3) of a movable
block (2) is diametrically expandable and contractible, the outer engaging member (31, 72)
makes a wedge engagement axially with the inner engaging member (21), and the outer
engaging member (31, 72), which is in the wedge engaged state, is movable toward a base end
35 and diametrically expandable for locking,

an output member (36) is inserted into the annular central pillar (20) axially movably, and an output portion of the output member (36) is connected to either the outer engaging member (31, 72) or the inner engaging member (21),

an input portion of the output member (36) is connectable to a driving means (D).

5 4. The clamping apparatus as set forth in claim 3, wherein

the outer engaging member is composed of an annular outer sleeve (31).

5. The clamping apparatus as set forth in claim 3, wherein

the outer engaging member is composed of a plurality of pressing members (72) arranged circumferentially at intervals,

10 an annular plug (71) to be inserted into the socket hole (3) is arranged on an outer periphery of the inner engaging member (21), each of the pressing members (72) is supported on a peripheral wall (71a) of the annular plug (71) radially movably and is movable radially inward by a restoring means (74), the output portion of the output member (36) is connected to either the annular plug (71) or the inner engaging member (21).

15 6. The clamping apparatus as set forth in claim 3, wherein

the inner engaging member (21) is diametrically expandable and contractible.

7. The clamping apparatus as set forth in claim 3, wherein

the outer engaging member (31, 72) is advanced toward the leading end by an advancing means (25), and during the locking movement, the outer engaging member (31, 72) moves toward the base end against the advancing means (25) while diametrically expanding.

8. The clamping apparatus as set forth in claim 3, wherein

the inner engaging member (21) is diametrically expandable and contractible, an annular clearance (92) is formed between the central pillar (20) and the inner engaging member (21), and during the locking movement, the outer engaging member (31, 72) diametrically contracts the inner engaging member (21), and the outer engaging member (31, 72) moves toward the base end while diametrically expanding.

9. The clamping apparatus as set forth in claim 3, wherein

the outer engaging member (31, 72) makes a wedge engagement with the inner engaging member (21) from the leading end side.

30 10. The clamping apparatus as set forth in claim 3, wherein

the outer engaging member (31, 72) makes a wedge engagement with the inner engaging member (21) from the base end side.

11. The clamping apparatus as set forth in claim 3, wherein

substantially an entire circumference of an inner peripheral surface of the engaging member (21) is adapted to come into close contact with an outer peripheral surface of the central

pillar (20).

12. The clamping apparatus as set forth in claim 3, wherein
at least one slit (22) is provided in a peripheral wall of the inner engaging member (21),
and the inner engaging member (21) is diametrically expandable by its own elastic restoring
5 force.

13. The clamping apparatus as set forth in claim 3, wherein
a pair of projecting portions (62) (62), which radially face each other, are provided on at
least one of the outer periphery of the central pillar (20), an inner or outer periphery of the inner
engaging member (21) and an inner or outer periphery of the outer engaging member (31), while
10 escape grooves (63) (63) are formed between these projecting portions (62) (62).

14. The clamping apparatus as set forth in claim 3, wherein
the central pillar (20) is fixed to the reference block (1).

15. The clamping apparatus as set forth in claim 4, wherein
the inner engaging member (21) is attached to at least one of the central pillar (20) and
15 the output member (36) radially movably.

16. The clamping apparatus as set forth in claim 3, wherein
the central pillar (20) is supported on the reference block (1) radially movably.

17. The clamping apparatus as set forth in claim 1 or 3, wherein
in a state that the output member (36) has moved toward the leading end for releasing,
20 the movable block (2) is received by the reference block (1) via the output member (36), and a
seating gap (α) is formed between a support surface (1a) of the reference block (1) and a
supported surface (2a) of the movable block (2).

18. A clamping system using the clamping apparatus as set forth in claim 1 or 4, wherein
two of the socket holes (3) (3) are provided in the movable block (2) at a predetermined
25 interval,

a first plug means (11) and a second plug means (12) corresponding to the respective
socket hole (3) (3) are provided in the reference block (1),

each of the plug means (11) (12) has the central pillar (20), the inner sleeve or the inner
engaging member (21) and the outer sleeve (31),

30 the first plug means (11) is composed so that substantially an entire circumference of an
inner peripheral surface of the inner sleeve or substantially an entire circumference of an inner
peripheral surface of the inner engaging member (21) is adapted to come into close contact with
an outer peripheral surface of the central pillar (20),

the second plug means (12) is provided with a pair of projecting portions (62) (62), which
35 radially face each other, on at least one of an outer periphery of the central pillar (20), an inner or

outer periphery of the inner sleeve or the inner engaging member (21) and an inner or outer periphery of the outer sleeve (31), while escape grooves (63) (63) are formed between these projecting portions (62) (62).

19. A clamping system using the clamping apparatus as set forth in claim 2 or 5, wherein

5 two of the socket holes (3) (3) are provided in the movable block (2) at a predetermined interval,

a first plug means (11) and a second plug means (12) corresponding to the respective socket hole (3) (3) are provided in the reference block (1),

10 each of the plug means (11) (12) has the central pillar (20), the inner sleeve or the inner engaging member (21), the annular plug (71) and a plurality of the pressing members (72),

the first plug means (11) is composed so that substantially an entire circumference of an inner peripheral surface of the inner sleeve or substantially an entire circumference of an inner peripheral surface of the inner engaging member (21) is adapted to come into close contact with an outer peripheral surface of the central pillar (20), and three or more of the pressing members (72) are arranged circumferentially at intervals,

15 the second plug means (12) is provided with two of the pressing members (72), which radially face each other.

20. The clamping system as set forth in claim 18, wherein

at least one other socket hole (3) is provided in the movable block (2),

20 a third plug means (13) only for locking corresponding to said other socket hole (3) is provided in the reference block (1).

21. The clamping system as set forth in claim 19, wherein

at least one other socket hole (3) is provided in the movable block (2),

25 a third plug means (13) only for locking corresponding to said other socket hole (3) is provided in the reference block (1).

22. The clamping system as set forth in claim 20, wherein

the third plug means (13) has the central pillar (20), the inner sleeve or the inner engaging member (21), and the outer sleeve (31), the central pillar (20) is fixed to the reference block (1),

30 the inner sleeve or the inner engaging member (21) is attached to at least one of the central pillar (20) and the output member (36) radially movably.

23. The clamping system as set forth in claim 21, wherein

35 the third plug means (13) has the central pillar (20), the inner sleeve or the inner engaging member (21), the annular plug (71) and a plurality of the pressing members (72), and the central pillar (20) is fixed to the reference block (1), and the inner sleeve or the inner engaging

member (21) is attached to the central pillar (20) radially movably.

24. The clamping system as set forth in claim 20, wherein

the third plug means (13) has the central pillar (20), the inner sleeve or inner engaging member (21), and the outer sleeve (31), and the central pillar (20) is supported on the reference
5 block (1) radially movably.

25. The clamping system as set forth in claim 21, wherein

the third plug means (13) has the central pillar (20), the inner sleeve or the inner engaging member (21), the annular plug (71) and a plurality of the pressing members (72), and the central pillar (20) is supported on the reference block (1) radially movably.

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